

**AMERICAN WATER RESOURCES ASSOCIATION-
WISCONSIN SECTION**

29th ANNUAL MEETING

**WISCONSIN'S WATERS: A CONFLUENCE OF
PERSPECTIVES**

March 3 & 4, 2005

**Lake Lawn Resort
Delavan, Wisconsin**

Hosts:

**American Water Resources Association-Wisconsin Section
University of Wisconsin Water Resources Institute
Wisconsin Department of Natural Resources
Center for Watershed Science & Education, UW-Stevens Point
Wisconsin Geological and Natural History Survey
U.S. Geological Survey, Wisconsin District**

Atrazine Concentrations in Mill Creek, Portage/Wood Counties, Wisconsin. B. Miller*

The Distribution of Phosphorus in Dorn Creek.
R.S. Nestingen*

Total Suspended Solids-Turbidity Correlation in
Northeastern Wisconsin Streams. T.J. Randerson*

Potential Applications of Biosensors in Water Monitoring.
M.V. Rigo*

Monitoring and Modeling of Enteric Pathogen, Microbial
Indicator and Real-Time Environmental Data at Inland
Beaches in Madison, Wisconsin. R.J. Waschbusch

7:00 **Dinner** – *Lake Lawn/Queens Room*

Banquet Speaker – **Dale Robertson**, Research
Hydrologist, U.S. Geological Survey

Friday, March 4, 2005

7:00 – 8:30 AWRA-Wisconsin Section Board of Directors’
Breakfast Meeting – *Courtyard 1*

8:30 – 10:10 **Concurrent Sessions 3A and 3B**

**Session 3A – Groundwater Quality Investigations –
*Geneva 1***
Moderator: Chris Carlson, WI Department of Natural
Resources

8:30 Evidence for Denitrification in Wisconsin Cranberry
Production. D.S. Randhawa*

8:50 Investigation of Three Flowpaths of Different Lengths,
Allequash Basin, Vilas County, Wisconsin. M.D. Masbruch*

9:10 An Assessment of Wisconsin’s Natural Attenuation Closure
Protocol. N.R. Keller*

9:30 Has Acid Deposition Affected the pH of Wisconsin’s
Groundwater? D.L. Ozsvath

An Assessment of Wisconsin's Natural Attenuation Closure Protocol.

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The State of Wisconsin has had approximately 19,000 leaking underground petroleum storage tank (LUST) sites. In 1996 Wisconsin administrative rule changes allowed site closure on the basis of remediation by natural attenuation. Once the regulatory agencies (WI DNR or WI Dept. of Commerce) judge evidence to be sufficient to assume that natural attenuation processes are controlling the plume, sites are closed and monitoring wells are abandoned. Currently there is no post-closure monitoring to evaluate the assumptions made at the time of closure. To assess the effectiveness of protocols used to make closure decisions for sites with residual contamination we have established a two component study. First we have built a database of information extracted from a subset of closed LUST sites included on the Wisconsin GIS Registry of Closed Remediation Sites. Information from this database is being used to determine if information collected prior to closure was sufficient or appropriate to constrain directions of plume migration and to demonstrate stabilization or decreases in contaminant concentrations within the plume. The second component consists of field studies at a small number of sites selected from the database. Two of the field studies were initiated during the summer of 2004. At these sites we re-established a monitoring system similar to the system at the time of closure, and also added additional monitoring points. We sampled for gasoline contaminants to determine changes in the contaminant distribution since the time of closure.

Preliminary results from the field studies show that the leading edges of the contaminant plumes have advanced relative to the assumed positions at the time of closure, suggesting that the plumes had not stabilized at the time of closure.

Keywords: natural attenuation, petroleum, protocol, LUST

*Note: This is a student presentation

An Assessment of Wisconsin's Natural Attenuation Protocol



Nathaniel Keller, UW-Madison
Jean Bahr, UW-Madison
Rachel Greve, UW-Madison
Theresa Evanson, WDNR
Aristeo Pelayo, WDNR
Jennifer Skinner, WDCOMM



Background

- The State of Wisconsin has had approximately 19,000 Leaking Underground Storage Tank (LUST) sites
- Petroleum Environmental Cleanup Fund Act (PECFA) shortfall, remediation cost vs. results
- Administrative rule changes in November 1996 allowed for site closure with concentrations above environmental standards if certain criteria were met
- Assumed natural attenuation would reduce concentrations “within a reasonable period of time”
- Similar studies in other states (Arizona in 2003)

Purpose of Study

- Determine if information submitted at closure is sufficient to evaluate natural attenuation as a remedy
- Determine, for 2 sites, if forecasts made at time of closure have proven to be correct
- Identify site conditions that may need modified closure conditions or post closure monitoring
- Apply current closure protocol to selected sites to determine effectiveness
- Use results to modify site investigations and how site reviews are conducted

Research Methods

- 2 Components of Study
 - Database
 - Data extracted from LUST file review (187 fields)
 - PDF Forms
 - Access Database
 - Field Studies
 - Sites selected from database (4 criteria)
 - Re-establish monitoring system

DATA LOG SHEET

General Site Information

Site Name: Martin Oil
 BRRTS#: 0313000420
 Facility ID#: -1
 Closure Date: 08/10/1999

File Analyzed by: NK
 Date: 06/08/2004

Consulting Firm: RMT Inc Street Address: 744 Heartland Tr City: Madison State: WI Zip: 53717 Phone #: 608-831-4444

Facility Name: Martin Oil, DOT 2800 Blk of Nana Ln Madison WI 53713

Location WTM_E (m): 572,596.0 County: Dane
 WTM_N (m): 286,082.0 Township: 7 N Range: 9 E
 Qtr / Qtr / Qtr: N/A ¼ of NE ¼ of NE ¼ of Section 36
 Other Descriptors: N/A

Setting Urban Mixed

Number of UST sites within ¼ mi (1320 ft): 0
 Distance to closest UST (ft): 1,800.0 Crossgradient

No. of GW receptors within ¼ mile of the source: 1
 Distance of center of source to closest GW receptor (ft): 250.0
 Other receptors of concern (list): N/A
 Distance (ft): -999.0

Site Dimensions Length (ft): 480.0 Width (ft): 360.0

QA/QC Review

Joint review of source zone & plume: N/A Date: 03/26/1954
 Peer review of file: N/A Date: 03/26/1954
 Peer review of data log entry: N/A Date: 03/26/1954

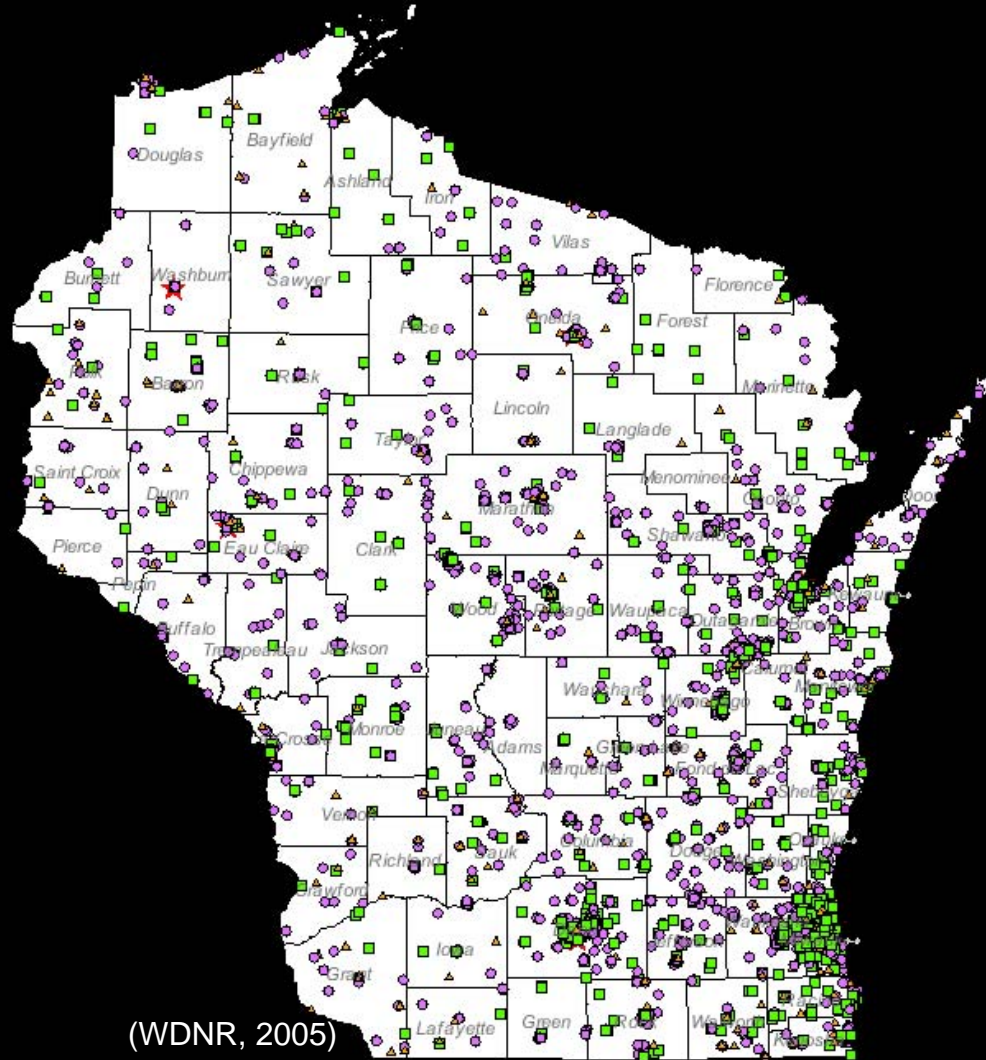
Characteristics of interest

	YES	NO	Unknown
Extensive GW analytical record?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBE monitoring?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Piezometers on site? <u>Put no. of piezometers in the adjacent box.</u> <u>3</u>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Possible Water Level / Concentration relationship?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
NA monitoring parameters?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Degradation rate data?	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Others (List): <u>N/A</u>			
Number of downgradient monitoring wells > 250 ft away from site	<u>0</u>		

RESET FORM

Database Site Selection

- Sites closed in 1999 and 2000
- Listed on the DNR GIS Registry of Closed Remediation Sites (1377 sites)
- Statistically distributed by county as sites on the registry
- Sites closed by both DCOMM and DNR



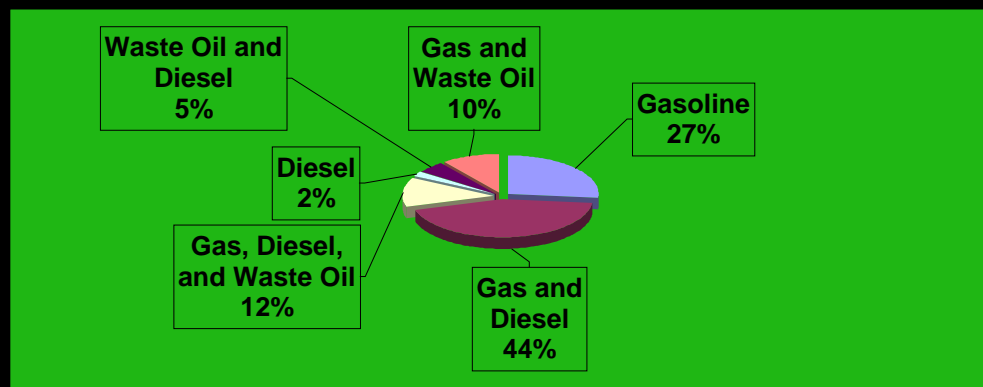
Database Statistics

- Approximately 60 sites reviewed
 - Well Results
 - 1/3 had piezometers
 - 7% had no downgradient wells
 - Average number of wells per site - 7
 - Average number of downgradient wells per site – 2

– Sampling Strategy

- Average length of sampling - 4 years
- Average number of sampling rounds - 8 rounds

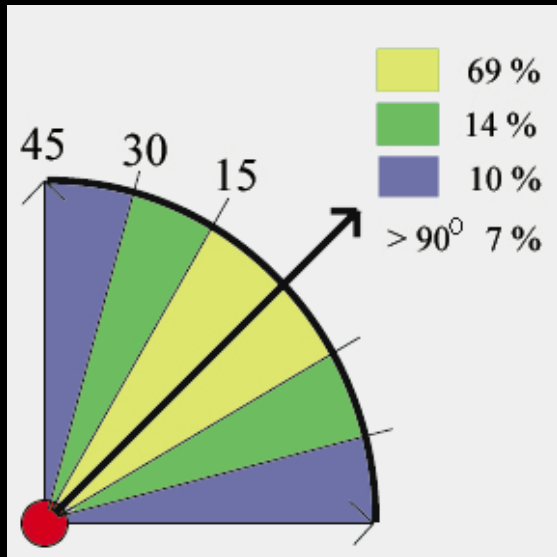
– Types of Contamination



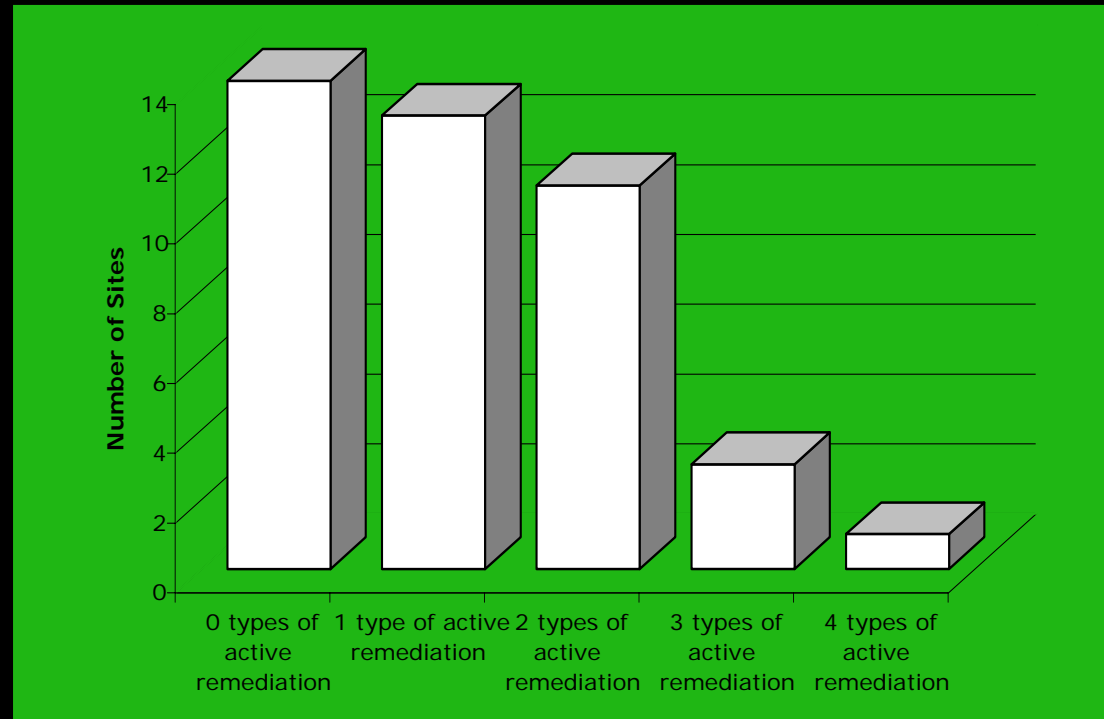
Database Statistics

– Flow Results

- Average seasonal variability in flow direction – 30 degrees
- Up to 3 orders of magnitude variation in hydraulic conductivity

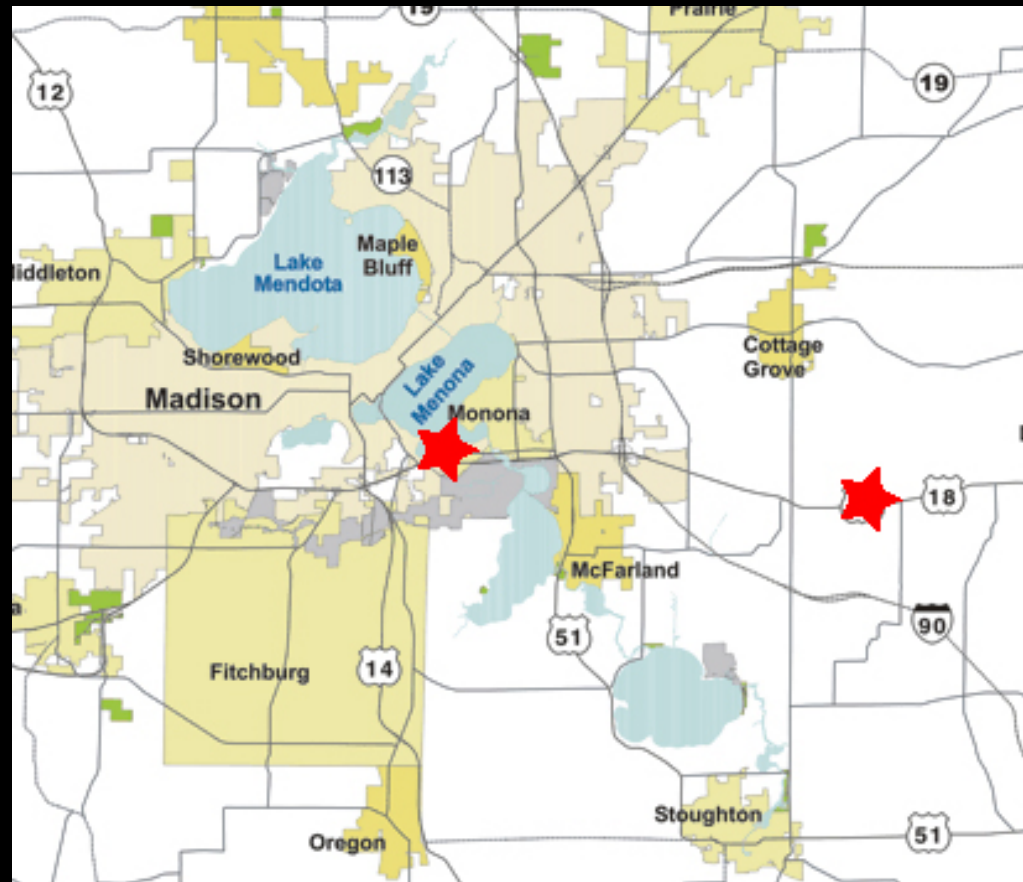


– Remediation Results



Field Studies

- 2 Sites in Dane County
- Re-established monitoring system
- Collected soil samples from source zone
- Conducted 2 rounds of groundwater sampling (BTEX and NA parameters)

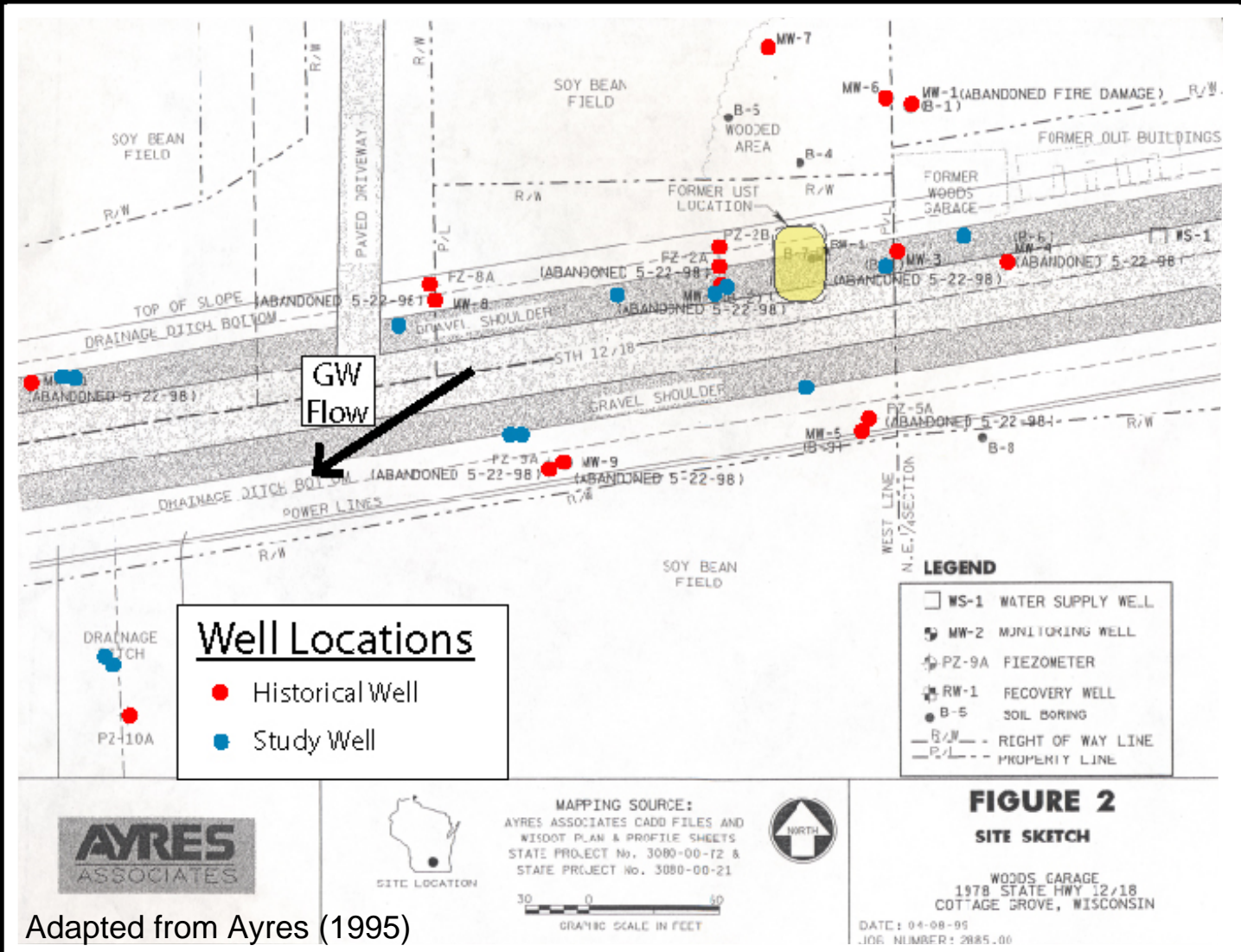


Former Wood's Garage

- Closed in September, 2000
- No remedial action taken
- Well characterized site (17 wells, 8 yrs of monitoring)

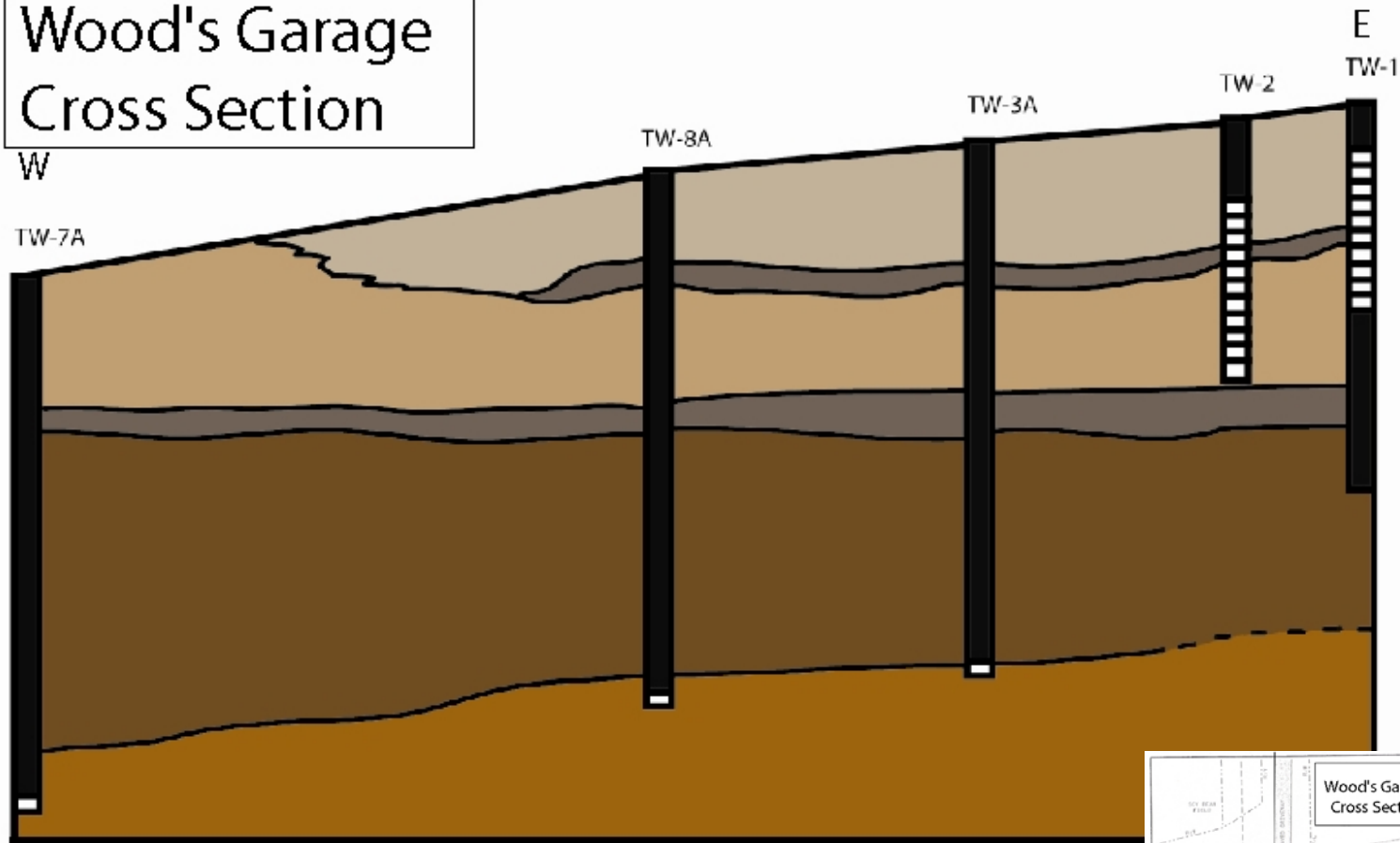


Wood's Garage

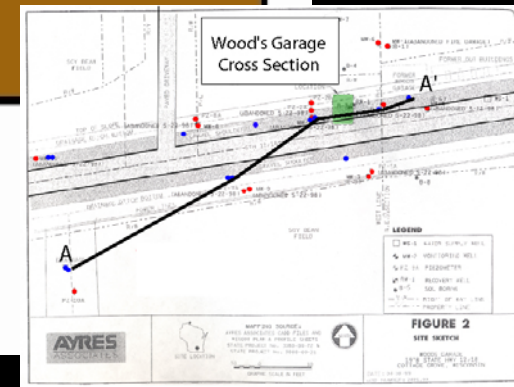


Wood's Garage Hydrogeology

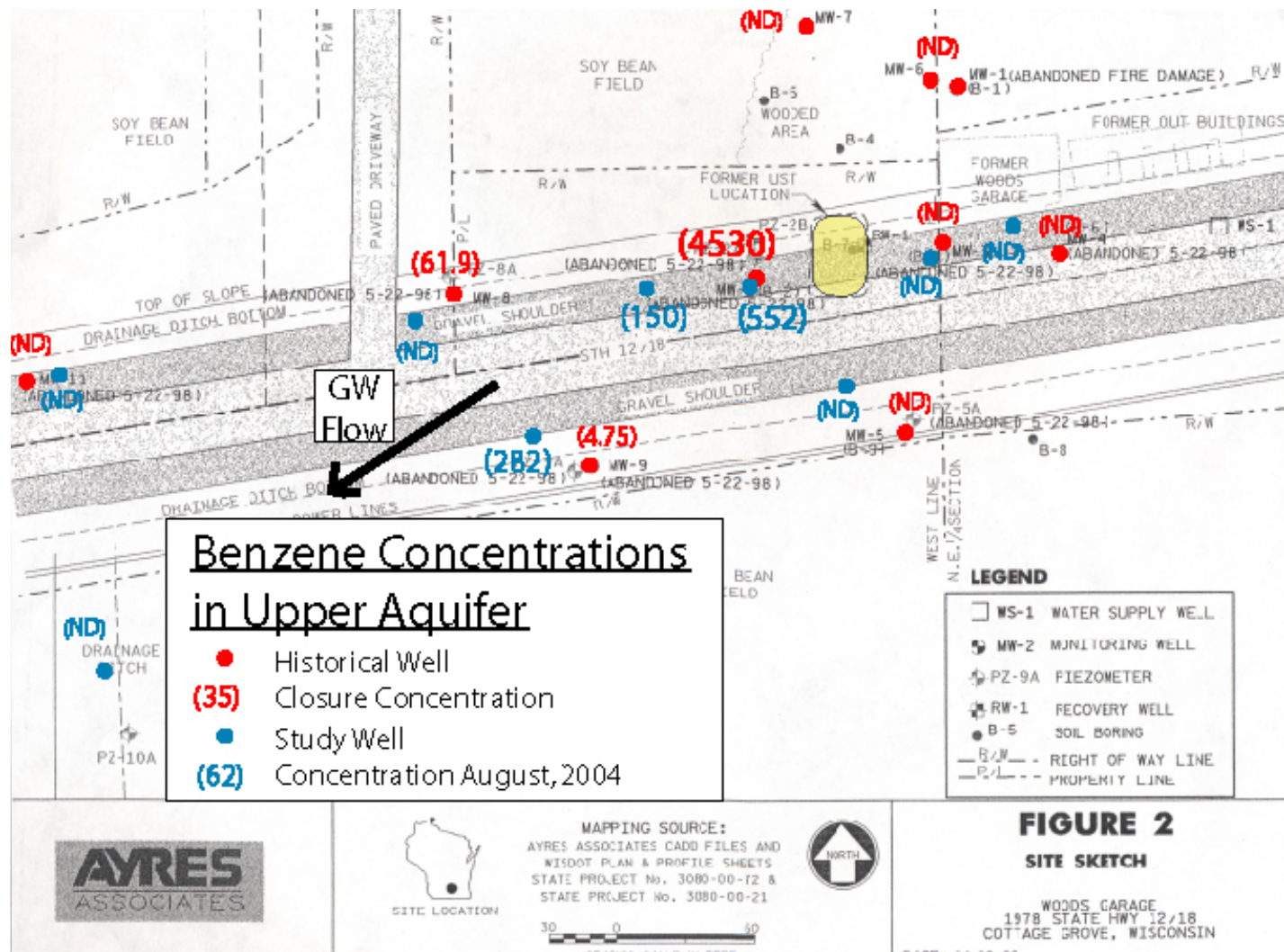
Wood's Garage Cross Section



- | | | |
|---------------------------------|---------------------------|-----------|
| Gravelly Sand and Silt | Sandy Gravel With Cobbles | Sandstone |
| Silty Sand With Trace of Gravel | Densely Packed Silty Sand | |

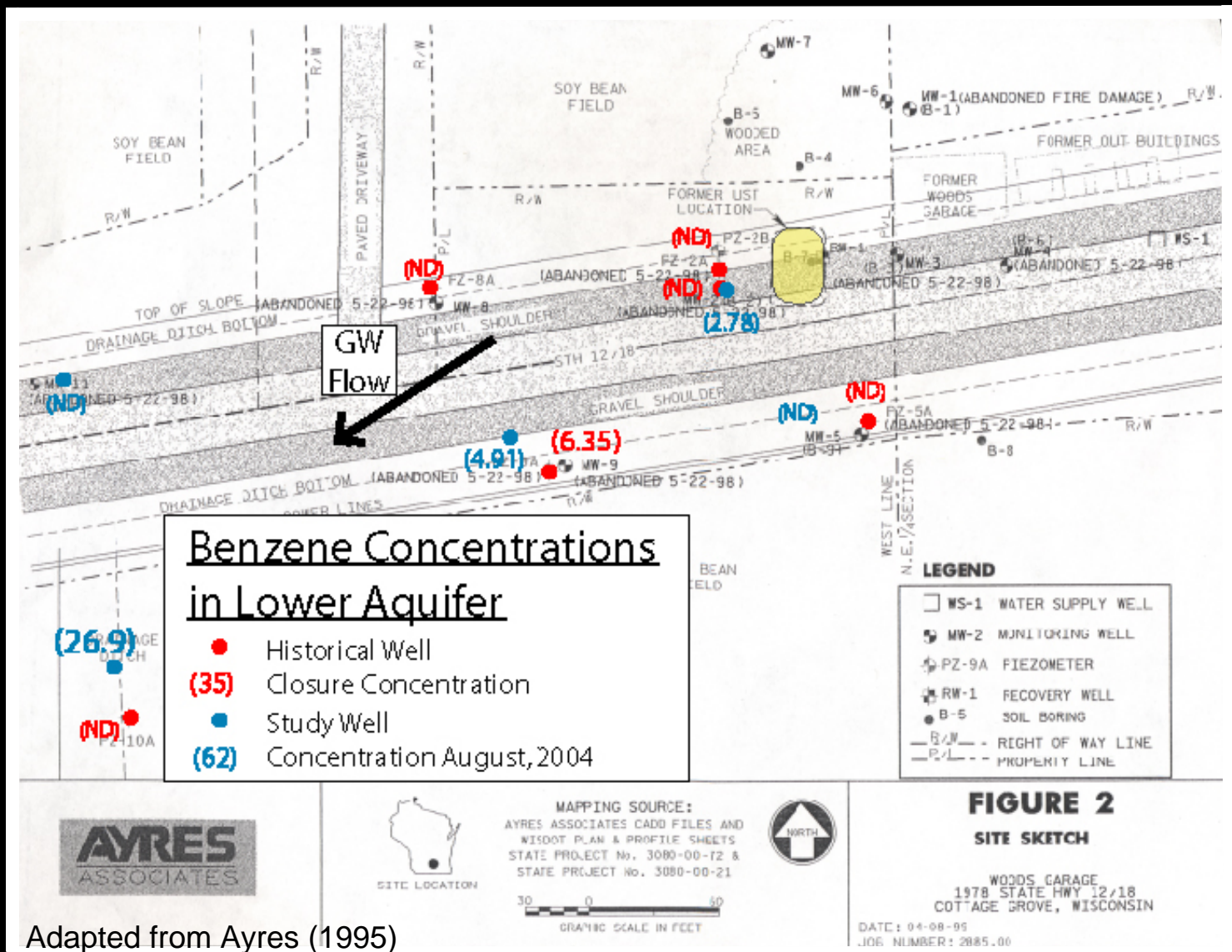


Upper Aquifer Concentrations



Adapted from Ayres (1995)

Lower Aquifer Concentrations



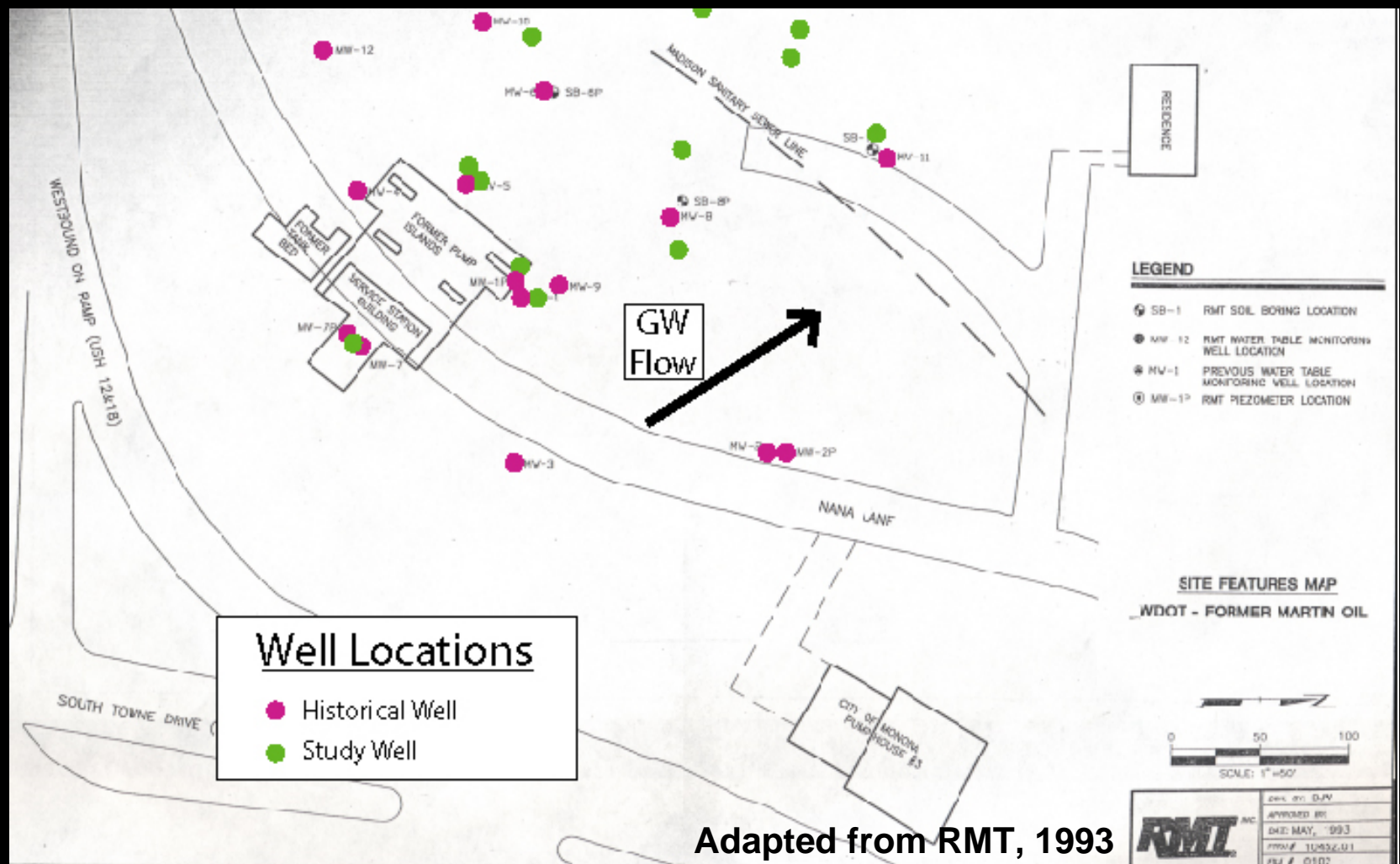
Adapted from Ayres (1995)

Thut Park (Former Martin Oil)

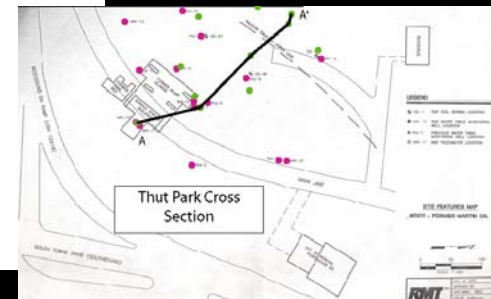
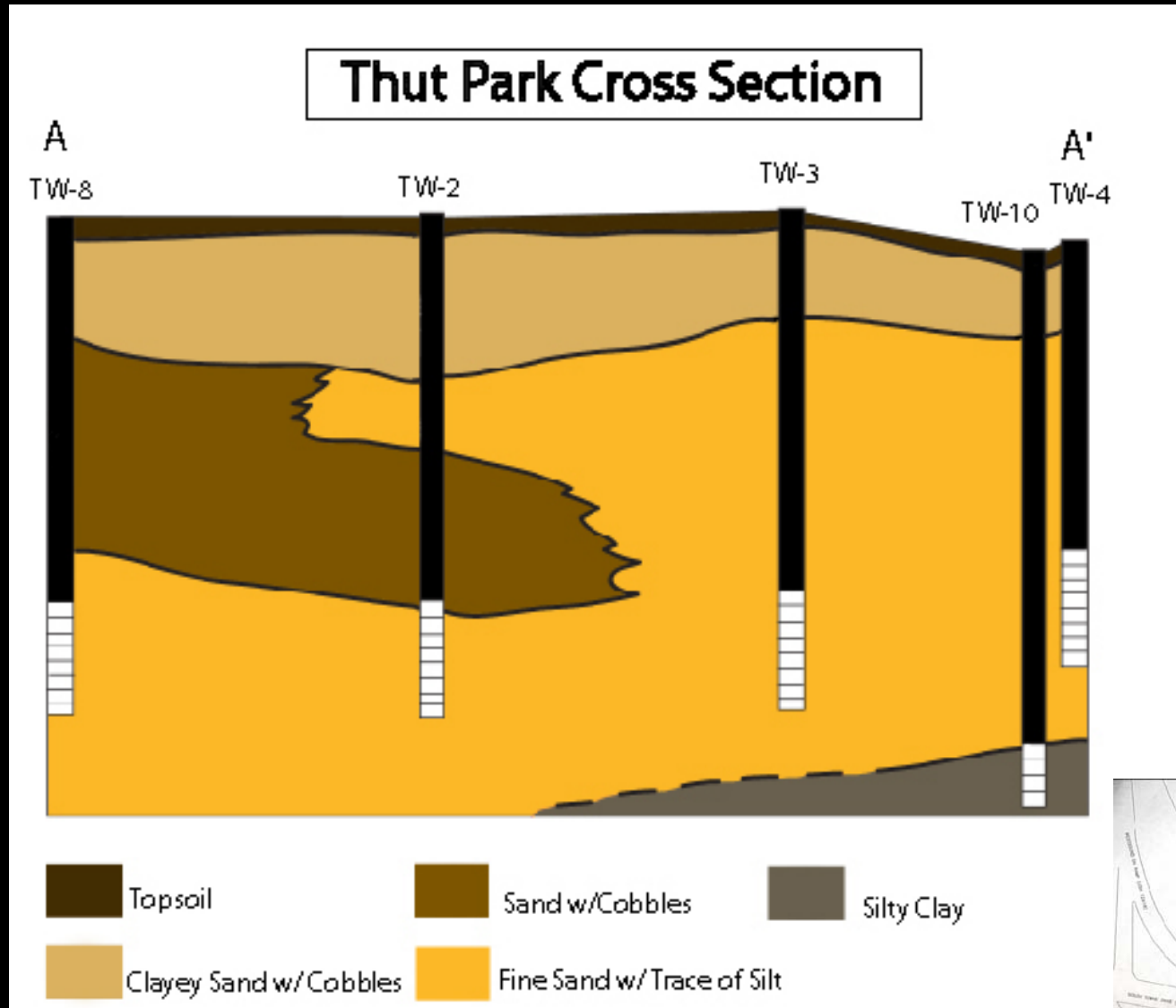
- Closed in August 1999
- Large Scale Excavation (~3000 cubic yards)
- Remediation (SVE & GW Extraction) shut down in June 1998
- Well characterized site (15 wells, 10 yrs of monitoring)



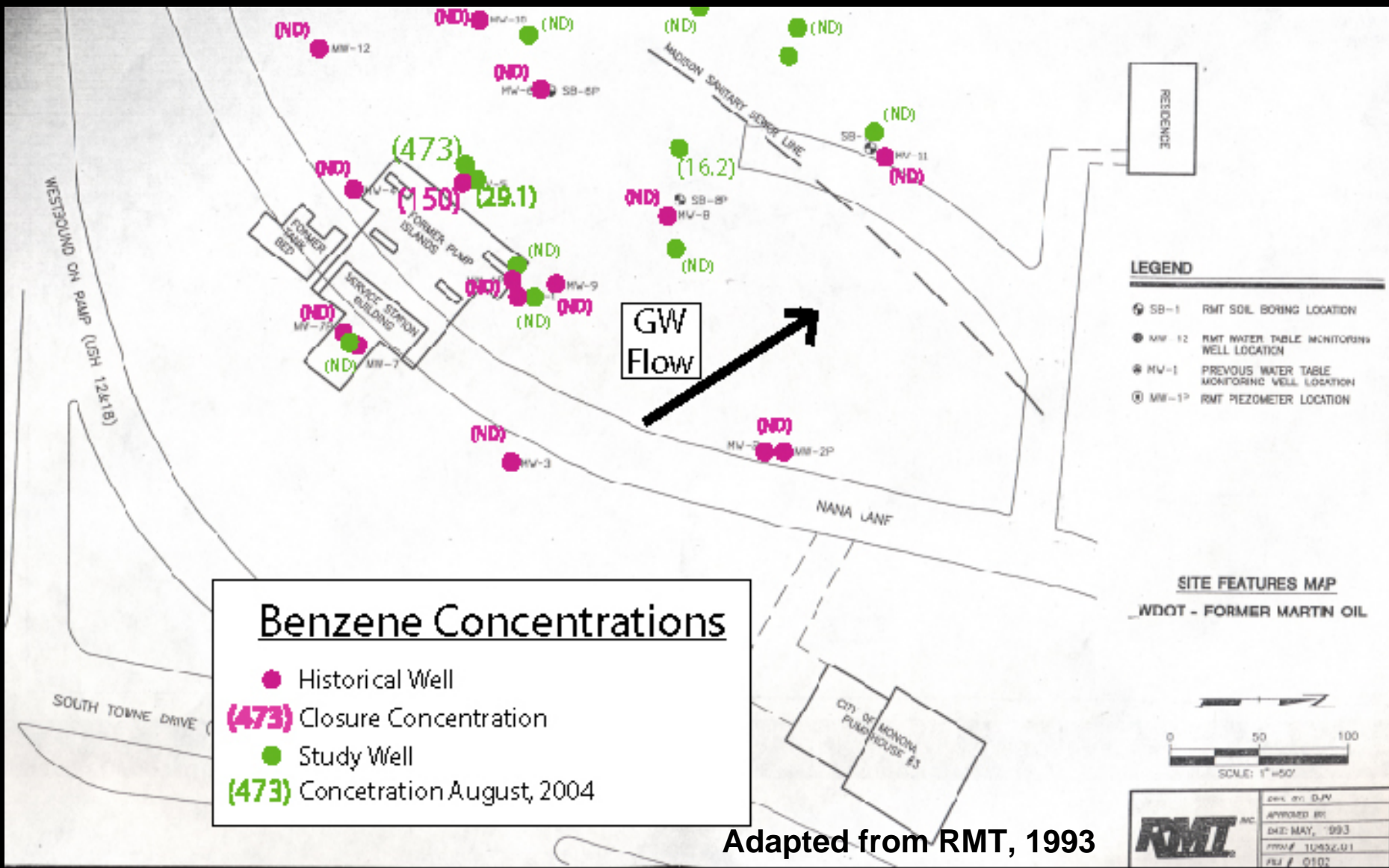
Thut Park



Thut Park Hydrogeology



Thut Park Results



Conclusions

- Database results show almost all closed sites are sufficiently characterized (i.e. plume margin is defined, flow directions are identified, etc.)
- Field results demonstrate that at both sites overall contaminant concentrations in groundwater have decreased, while the plume margin has advanced
- For these two field sites assumptions that the plume was stable or receding was incorrect

Future Work

- Continued addition of sites to database
- Additional queries and analysis of database, including statistical analysis of groundwater information
- 8 additional field studies throughout the state starting spring of 2005
- Continued monitoring of current field sites through fall 2005, to establish seasonal contaminant trends

Acknowledgements

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WDOT

